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## California Five-Spined Engraver Beetle

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The California five-spined engraver (*Ips confusus* Lec.) is one of the most aggressive pine engraver beetles, attacking nearly all pine species. Its activity is greatest during periods when abundant slash results from logging or land clearing operations and from wind-falls or snow breakage, but sometimes sporadic attacks occur without evident association with slash. During outbreaks many thousands of trees are killed from midsummer to fall; they occur in varying-sized groups which often exceed 500 trees. Infestations are confined primarily to poles, reproduction, and young merchantable-sized trees under 26 inches d. b. h. Frequently many of the older trees are top-killed. This insect is often associated with the western pine beetle (*Dendroctonus brevicornis* Lec.), and at times the killing attributed to the latter species is in reality by both species. Hence, there are no reliable estimates on timber losses caused by this insect alone.

The California five-spined engraver beetle is native to southern Oregon and California. Its range extends throughout the area west of the Cascades from the Rogue River drainage in southwestern Oregon to the Laguna Mountains in southern California (fig. 1). It is most active in young second-growth ponderosa pine at elevations ranging from 2,000 to 4,500 feet.

### Host Material

Fresh slash is preferred to living trees from early spring to mid-summer. This material absorbs most of the adults that emerge from mid-April or earlier to mid-July. Large beetle populations develop especially in cut tree tops and other stems over 3 inches in diameter.

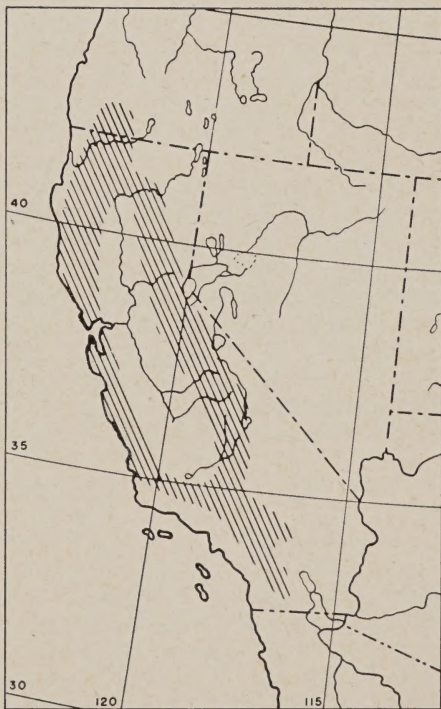


Figure 1.—Distribution of the California five-spined engraver beetle.



Adults emerging from slash after midsummer attack and kill living trees; but the incidence and severity are associated with stand weaknesses evidently induced by deficient soil moisture in years of sub-normal spring precipitation, and with the absence of fresh slash.

The host trees attacked and killed or top-killed include primarily ponderosa pine (*Pinus ponderosa*), sugar pine (*P. lambertiana*), Coulter pine (*P. coulteri*), and Monterey pine (*P. radiata*). Its attacks and broods have been reported in western white pine (*P. monticola*), knobcone pine (*P. attenuata*), fox-tail pine (*P. balfouriana*), Jeffrey pine (*P. jeffreyi*), pinyon pine (*P. monophylla*), and Digger pine (*P. sabiniana*).

### Evidences of Infestation

Infested trees are readily detected by uniform fading of the top or all of the crown foliage, from yellowish to reddish brown (fig. 2). They become evident usually from late July or August on through the fall, and frequently during the winter. They may be detected prior to fading by the presence of reddish bark borings in bark crevices, branch axils, and cobwebs. In slash these borings pile up into mounds around each beetle entrance along upper surfaces.

### Description

The beetle passes successively through four distinct stages: egg, larva, pupa, and adult. The tiny cylindrical eggs are pearly white. They hatch into yellowish white, legless grubs or larvae, which, when fully grown in 14 to 21 days, transform to whitish, quiescent pupae, then to adults. The adults, each about the size of a rice grain, are pale yellow at first, but change within 2 weeks during summer to dark reddish brown and black. At

temperatures about 65° F. they emerge and fly readily to new fresh slash or living trees.

### Life History

The number of generations varies from two per year in the northerly to five per year in the southerly limits, with an average of three to four generations throughout most of the range. One generation more or less than the average for a given locality is apt to occur as a result of seasonal variations in temperature. The overwintering stages are predominantly callow to mature adults, pupae, and mature larvae. They remain under the bark of trees or slash during this dormant period. Ordinarily the initial spring attacks by overwintered adults in the central part of the range begin by mid-April. Attacks occur constantly until early November, with peak adult flights on or about May 10, June 25, August 10, and September 25.

### Habits

Each attack is initiated by a male beetle which bores a nuptial chamber 2 to 3 times his size in the inner bark. He is subsequently joined by 2 to 5 females, usually 3, each of which constructs a single straight egg tunnel 4 to 6 inches long. Eggs are deposited in niches along the sides of each tunnel. Joining at the nuptial chamber, the three egg tunnels form the typical inverted tuning fork pattern of open runways which is characteristic of this species.

Parent adult emergence is characteristic within 20 to 30 days after initial attacks, but the incidence is influenced by degree of crowding. These adults make a second attack and resultant brood.

Eggs hatch within 5 to 14 days. The larvae mine within the inner phloem at right angles to the egg



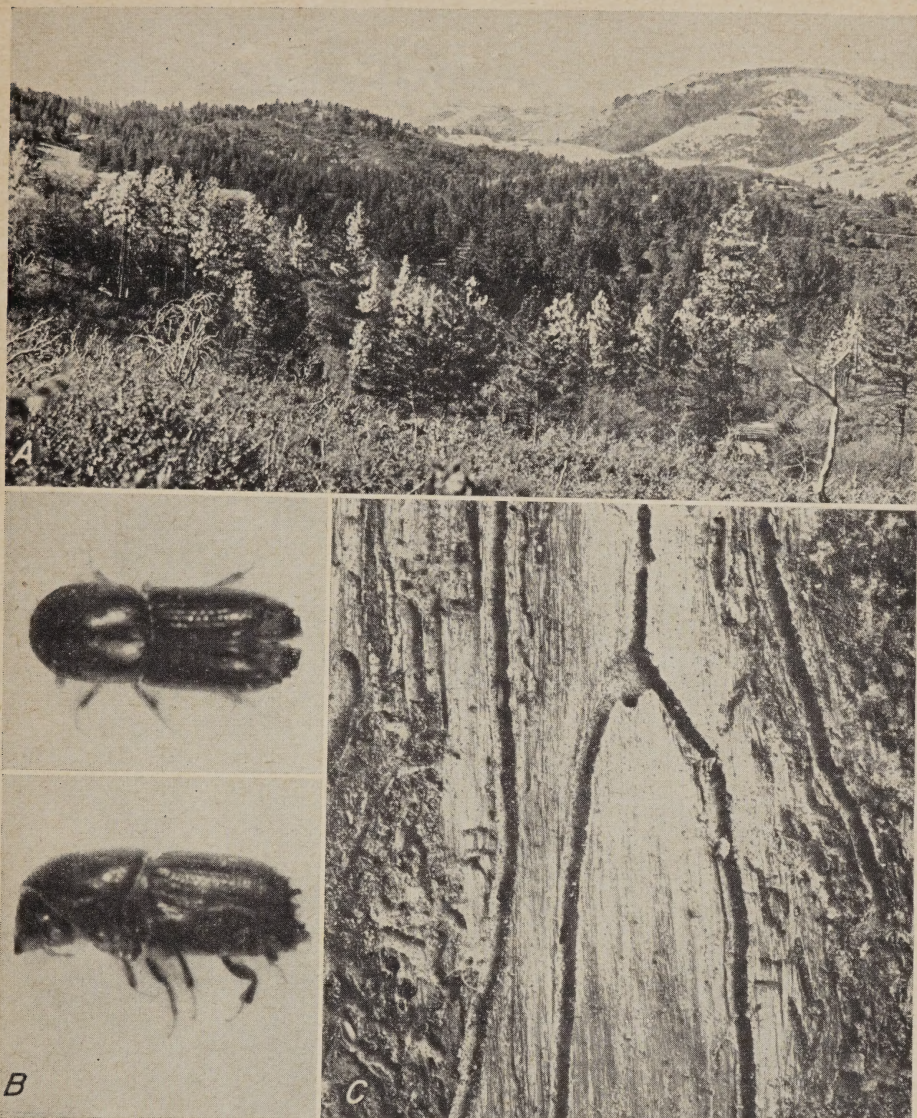


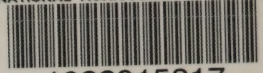
Figure 2.—California five-spined engraver beetle: A, Aggressive killing in Coulter pine; B, adult; C, egg galleries in soft inner bark.

tunnel, and when fully grown they pupate in individual cells hollowed out in the phloem tissue. As the adults emerge from these cells, they congregate in numbers beneath the bark until mature, then bore to the outside, many leaving through the same exit hole.

Frequently mass attacks are made during midsummer and fall

in reproduction and pole-size trees. In such instances, adults numbering from 200 to 500 per square foot of bark surface feed gregariously in the phloem, rarely producing broods. Re-emergence occurs within 3 weeks from summer invasions; those invading in the fall remain under the bark until spring before re-emerging.





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## Natural Control

A number of insect enemies and associates, mites, fungi, and micro-organisms follow closely behind successful attacks and the young developing beetle broods, to prey upon, parasitize, and compete with them for food. The combined effect of all these organisms, and in addition the adverse effect of prolonged high or low temperature and excessive or too little moisture, tend to hold the beetle populations in check. However, these control factors never occur in combinations sufficient to eradicate *Ips* populations completely.

## Preventive Control

Wherever possible the cutting of green ponderosa pine or other pines at elevations between 2,000 and 4,500 feet should be avoided until midsummer. This will prevent the buildup of excessive populations from overwintered adults under the optimum rearing conditions of this elevation range, where drought factors most often adversely affect tree resistance to attacks.

The amount of breeding in green slash is reduced to a minimum by exposing to direct sunlight, by lopping and scattering limbs, by applying toxic-oil sprays to bark surfaces, or by peeling within 10 to 15 days after the slash is created during spring and summer. Slash from winter windfall and snow breakage should be treated to prevent breeding or destroy broods prior to May 1.

## Applied Control

Direct control of infestations in trees is usually unnecessary unless exceptional outbreaks occur in combination with the western pine beetle and the latter species threatens epidemic killing. When war-

ranted, the method employed during fall, winter, and spring may be one of the following as governed by circumstances: (1) fell-peel-burn; (2) toxic penetrating oil sprays applied to the bark of felled trees; (3) salvage logging.

In the fell-peel-burn method infested trees are felled, then the bark is peeled from the top and sides of the main bole and spread with limbs along each side of the log, and burned. The process destroys broods completely. Burning is hazardous during dry weather, hence special precautions must be taken to guard against excessive scorching of adjacent trees and to keep the fire within bounds.

Toxic penetrating oil sprays are applied to all bark surfaces to the threshold of runoff. Maximum efficiency requires application to the upper surfaces only as logs are rolled. The most effective formulations to date are (1) 1½ pounds ethylene dibromide added to 5 gallons diesel fuel; (2) orthodichlorobenzene 1 part, diesel fuel 6 parts. At best, penetrating oil sprays are limited in effectiveness by bark thickness and texture, with maximum controlling effect beneath bark less than ¾ inch thick.

Salvage logging removes infested logs to the mill where broods are destroyed in the burner during the milling process. Efficiency is limited by the number of infested trees that can be removed from the woods in consideration of accessibility, character of equipment, and speed of operation before broods emerge.

## References

- INSECT ENEMIES OF WESTERN FORESTS.  
F. P. KEEN. U. S. Dept. Agr. Misc.  
Pub. 273, 280 pp., illus. (Rev.) 1952.  
THE CALIFORNIA FIVE-SPINED ENGRAVER: ITS  
BIOLOGY AND CONTROL. GEORGE STRUBLE  
and RALPH C. HALL. U. S. Dept. Agr.  
Cir. 964, 21 pp., illus. 1955.